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Digital Recursive Filters for Building Thermal Modelling

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Abstract

© 2018 IEEE. The digital recursive filters where proposed as models of the thermal dynamics of the building. The developed wireless system of temperature sensors has been applied in collecting a large body of data. From physical consideration, the first-order recursive filters describe the thermal dynamics in the observed temperature range adequate. Evaluation of the filter parameters was performed using system identification. The proposed models are usable in electronic control systems for energy-saving heating management.

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References

[1] A. Antoniou, Digital Filters: Analysis, Design, and Applications, 2nd ed. New York: McGraw-Hill, 1993.

[2] Jian Liang and Ruxu Du, "Thermal comfort control based on neural network for HVAC application, " Proceedings of 2005 IEEE Conference on Control Applications, 2005. CCA 2005., Toronto, Ont., 2005, pp. 819-824

[3] Im Cho, Young & Altayeva, Aigerim. (2017). Intelligent PID Controller for Smart Building Comfort Temperature Control Basedon Fuzzy Logic and Neural Networks. Journal of Korean Institute of Intelligent Systems. 27. 522-529. 10. 5391/JKIIS. 2017. 27. 6. 522.

[4] Åström, K. J. & Hägglund, Tore. (2018). PID controllers : theory, design, and tuning / Karl J. Astrom and Tore Hagglund.

[5] E. I. Jury, Theory and Application of the z-Transform Method, New York: Wiley, 1974

[6] C1111Sub 1GHz System On Chip with MCU, Texas Instruments, UserGuide.

[7] P. Bacher and H. Madsen, "Identifying suitable models for the heat dynamics of buildings, " Energy and Buildings, vol. 43, pp. 1511-1522, 2011.

[8] L. Ljung, Ed., System Identification (2Nd Ed.): Theory for the User. Upper Saddle River, NJ, USA: Prentice Hall PTR, 1999.

[9] L. Ljung, System identification toolbox for use with Matlab, 6th Edition, The MathWorks, 2003.

[10] P. V. Overschee and B. D. Moor, "N4SID: Subspace algorithms for the identification of combined deterministicstochastic systems, " Automatica, vol. 30, no. 1, pp. 75-93, 1994.

[11] Skruch Pawel. 2015. A Thermal Model of the Building for the Design of Temperature Control Algorithms. Automatyka/Automatics 18, 1 (2015).